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(71) Applicants
Hilti AG,
(Liechtensein),
FL-9494 Schaan,
Liechtenstein.
(72) Inventors
Dr Ernst Brennsteiner,
Dieter Scholz.
(74) Agent and/or address for service,
Barlow Gillet and
Percival,
94 Market Street,
Manchester,
M1 1PJ.

(54) Drill bit

(57) For securing a drill (1) in percussion drilling machines or in tool holders of hammer drills which have locking elements, the shank (3) thereof has longitudinal grooves (4) distributed around its circumference. The grooves (4) are subdivided by webs (5) into longitudinal portions (4*a*), (4*b*), 4(*c*) for engagement with locking elements. However, the ridge or surface of the webs (5) conform to the contour of the shank (3) and thus serves to support the jaws of a chuck of a percussion drilling machine in the correct operational position.

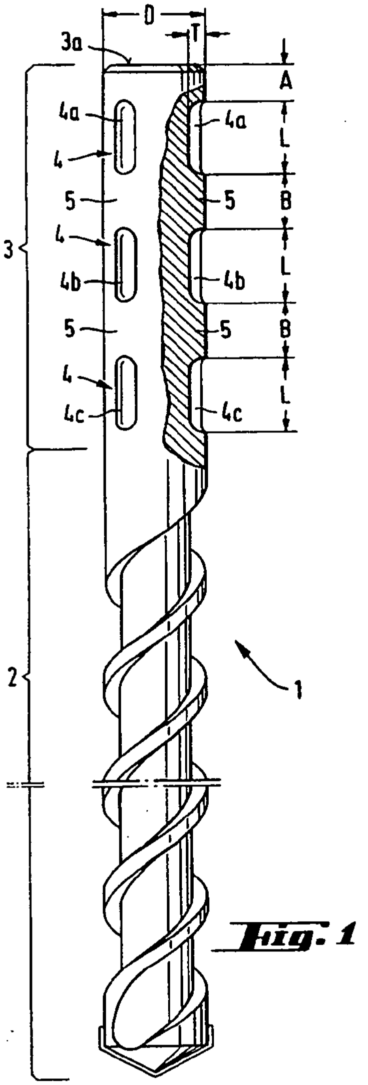

Fig. 1

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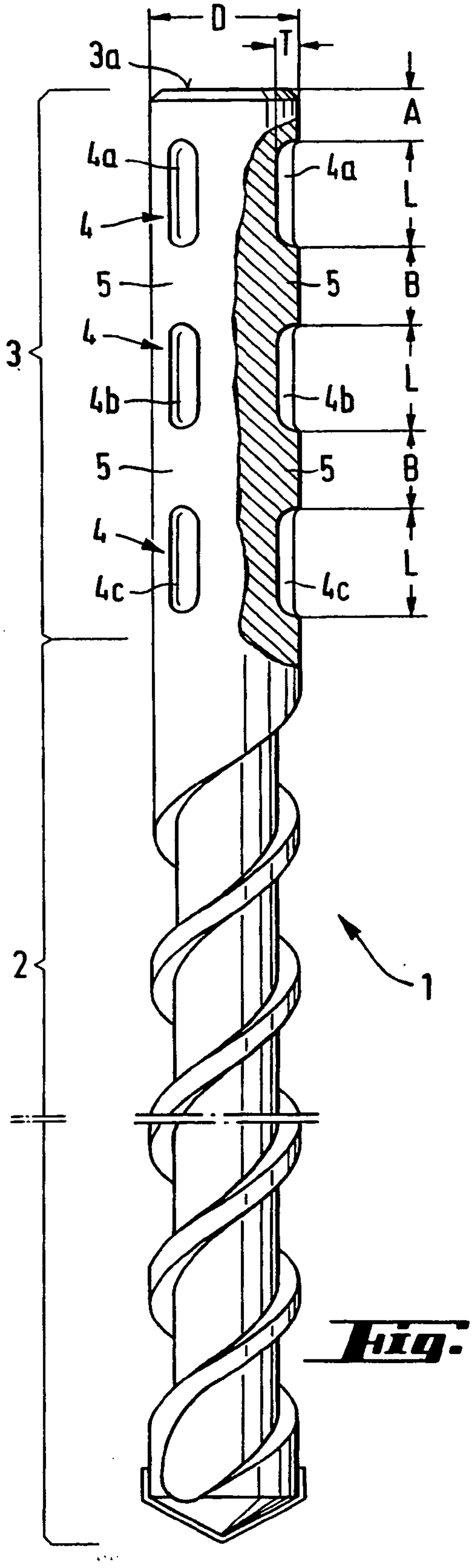
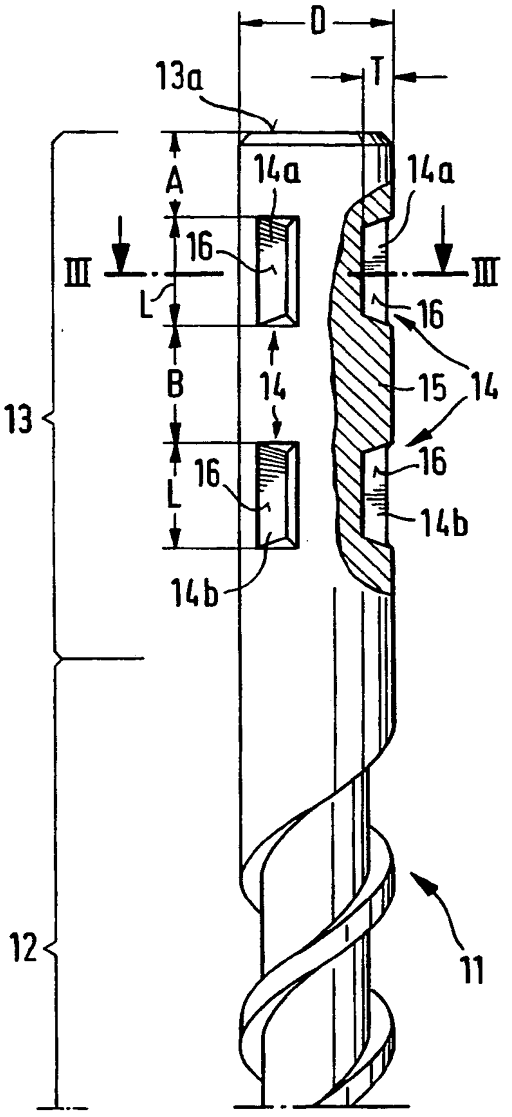


Fig. 1

Fig. 2



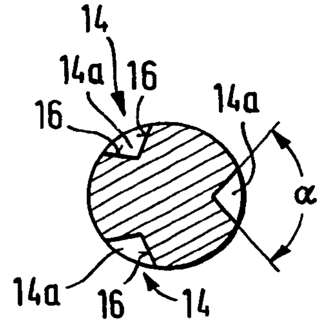


Fig. 3

SPECIFICATION

Drill for hand tools

This invention relates to a drill for hand tools having a shank wherein a closed longitudinal groove is formed.

Nowadays percussion drilling machines or hammer drills are used for drilling holes in hard materials such as concrete or rock. Of these two kinds of tools, the percussion drilling machines are most widely used on account of their comparatively low production costs. One further advantage of the percussion drilling machines is that they are equipped with drills which have a work region and a shank of the same diameter. By virtue of this equality of diameter, the drills are economical to produce and consequently may by purchased at a favourable price. In use, each such drill is fixed non-displaceably by way of its shank in a chuck which is variable in diameter. The relatively large diameter of the drill advantageously ensures effective transmission of torque to the drill since, the larger the drill diameter, the greater is the clamping area i.e. the area of contact between the shank and the chuck. Thus it is possible to impart a maximum of the power output of the percussion drilling machine to the drill.

The hammer drills are considerably more complicated in construction than the percussion drilling machines and have different kinematic conditions which require a fundamentally different manner of holding or mounting the drills. In particular, because of high kinetic energy of the impacts delivered to each drill during operation, the drill is required to have a certain axial mobility in the tool holder. Thus, special drills are provided for hammer drills, the most widespread being those having a shank wherein axially-closed longitudinal grooves are formed to permit engagement with locking elements of the tool holder.

The aforesaid basically different concepts of drill retention in percussion drilling machines and hammer drills contrasts with the economical need to interchange the drills of these types of tool. This need exists in all craft businesses which have both percussion drilling machines and hammer drills at their disposal. At present, there are usually a large number of drills of different diameters which can be used only in the particular type of tool for which they are designed. In other words, it is not possible to secure the favourably-priced drills intended for percussion drilling machines in hammer drills by means of the locking elements of the latter's tool holder. The converse is true for the hammer-drill drills, that the presence of grooves does not permit the jaws of the chuck to hold the drill centrally in the holder. This would result in the drill being inclined relative to the axis of the chuck and, thus, in excessive wear of the drill and the chuck.

Accordingly, an object of the invention is to provide a drill which, whilst retaining all the known performance advantages, related to correct fitment in a tool holder, is economical to produce and is suiable for percussion drilling machines and hammer drills.

With this object in view, the present invention proposes that the longitudinal groove or longitudinal grooves respectively is or are subdivided into longitudinal portions by at least one web the ridge or surface of which conforms to the contour of the shank.

This design of the shank makes possible the use of favourably-priced drills which are of the same diameter in their respective work regions and their shanks, and allows them to be successfully interchanged between the types of tools in question. The web, together with the regions bordering the longitudinal portions of the longitudinal groove or grooves, provides a support or bearing for the jaws of the chuck of a percussion drilling machine, so that an axially-correct and secure location of the drill in the percussion drilling machine is ensured. This in turn ensures minimum wear and low-loss transmission of force at the drill.

The design of the shank in accordance with the invention also permits retention of the drills in hammer drills in a manner which ensures good performance of such tools. The locking elements of the tool holder, correspond in number and position to the longitudinal portions of the groove or grooves and extend into these portions to provide a reliable hold of the drill with limited axial play.

It is possible to subdivide the longitudinal groove or grooves into further longitudinal portions by providing several webs arranged at a spacing from one another. This is particularly advantageous in the case of drills of large dimensions which require guidance over a considerable proportion of their length. In order to reduce the wear and to foster the transmission of force in hammer drill operation, more than two locking elements may extend into each longitudinal portion of the longitudinal groove or grooves. Each web may conveniently be formed by a zone of the initial cross-section of the shank which has been left untouched and on both sides of which border the longitudinal portions of the respective longitudinal groove.

Advantageously the distance between the front end of the shank and the end of the longitudinal groove nearest to said front end corresponds to 0.3 to 1 times the diameter of the shank. Thus the axial position of the attack or impingement of the jaws of the chuck or respectively of the locking elements of the tool holder is defined. This position determination is particularly advantageous in the event of use in hammer drills whose locking elements are adjusted or closed normal to the axis of the tool holder, in order to ensure that on each occasion the locking elements engage accurately into the longitudinal portions from the outset. In the case of a drill whose shank has a diameter of 10mm, this spacing may, for example, amount to 6mm.

Preferably the width of the web corresponds to 0.4 to 1.1 times the diameter of the shank. A web of this width ensures that in the appropriate circumstances jaws of the chuck, which come into abutment against the contour of the shank only in the region of the web, find support over an adequate zone in the central longitudinal portion of the shank. The width of the web, in the case of a shank of 10mm diameter, may, for example amount to 8mm.

The length of each longitudinal portion of the longitudinal groove advantageously corresponds to 0.7 to 1.7 times the diameter of the shank. This dimension ensures a suitable length of the longitudinal portions for the force-absorptive engagement of the locking elements and in addition guarantees that a jaw of the chuck which comes to rest over such a longitudinal portion can in no case fall into said portion, but instead find adequate bearing potential on the contour of the adjoining web or respectively the groove-free zone of the shank. The length of a longitudinal portion in the case of a shank having a diameter of 10mm may, for example, amount to 8mm.

In accordance with a further proposal of the invention, the depth of the longitudinal groove should correspond to 0.1 to 0.3 times the diameter of the shank. This groove depth permits problem-free engagement of the locking elements on the one hand and leads, on the other hand, to only minimal weakening of the shank. Furthermore, this depth of the longitudinal portions has the advantage that in conjunction with a groove cross-section shaped, for example, with an arcuate bottom or as a U, only relatively small zones of the shank contour are lost.

A most effective rotational entrainment of the drill may be achieved by longitudinal portions having a V-shaped cross-section. In this case, as the flanks of the longitudinal portions incline towards each other the locking elements are correspondingly substantially wedge-shaped in design. The resultant large area of co-operation between the groove flanks and the flanks of the locking elements guarantees minimal wear of these areas. In addition to the force transmitting capacity of this geometry, only a minimum loss of contour of the shank is ensured which is favourable for supporting the jaws of a chuck.

Whereas, in the case of a percussion drilling machine, the centring of the drill is effected by the jaws of the chuck, in the case of a hammer drill locking elements designed to correspond to the shape of the longitudinal groove are available for this purpose. In the case of a longitudinal groove having a V-shaped cross-section, the possibility exists of utilising predominantly the groove bottom or predominantly the groove flanks for centring the drill by means of locking elements. An angle in the approximate range 50° to 130° formed by the flanks of the longitudinal portions has proved a success for both kinds of centring. However, in the case of predominant centring on the groove bottom, the angle is advantageously somewhat larger, i.e. in the upper part of the indicated range, for example about 120°. In the case of centring where the groove flanks are predominantly utilised, the angle formed between the flanks advantageously lies in the approximate range 50 and 70° in view of the tangential forces which occur.

The invention will be described further, by way of example, with reference to the accompanying drawing in which:

Figure 1 is a side view, partially in section, of a first embodiment of a drill in accordanc with the present invention, which drill has three longitudinal grooves, each subdivided into longitudinal portions of U-shaped cross-section;

Figure 2 is a side view, partially in section, of a second embodiment of a drill in accordance with the present invention, which drill has three longitudinal grooves each subdivided into longitudinal portions, of V-shaped in cross-section; and

Figure 3 is a cross-section along the line III-III of Figure 2.

A first practical embodiment of the drill of the invention, as shown in Figure 1, is designated as a whole by reference numeral 1 and is composed of a work region 2 and a shank 3 in continuation therewith. Formed into this latter, distributed around the periphery or circumference, are three longitudinal grooves 4 of U-shaped cross-section. Each groove 4 is subdivided by two webs 5 into longitudinal portions *4a*, *4b*, *4c*, the ridge or surface of the webs 5 conforming to the contour of the convex surface of the shank 3.

The distance A between the respective ends of the longitudinal grooves 4 adjacent to the front end *3a* of the shank 3, and said front end *3a* corresponds to 0.4 times the shank diameter D. The width B of each web 5 is in this case, 0.6 times the shank diameter D. The longitudinal portions *4a*, *4b*, *4c* are of equal length L, which length L, corresponds in the depicted exemplified embodiment, to 0.8 times the diameter D of the shank 3. The depth T of the longitudinal portions *4a*, *4b*, *4c* corresponds, in the case of the exemplified embodiment, to 0.2 times the diameter D of the shank 3.

Figure 2 illustrates a second practical embodiment of the drill of the invention, which drill is designated as a whole by reference numeral 11 and has a work region and a shank 13. Three longitudinal grooves 14 distributed around the periphery or circumference of the shank 13 are each subdivided by a web 15 into two longitudinal portions *14a*, *14b* which are V-shaped in cross-section, as indicated clearly in Figure 3. The flanks 16 of the longitudinal portions *14a*, *14b* form an angle α which, in the selected exemplified embodiment, is 100°.

The distance A between the front end *13a* of the shank 13 and the respective ends of the longitudinal grooves 14 nearest said front end *13a* corresponds, in the exemplified embodiment of Figure 2, to 0.6 times the shank diameter D. The web width B and the length L of each of the longitudinal portions *14a*, *14b* correspond respectively to 0.8 times the shank diameter D. The depth T of the longitudinal grooves 14 corresponds to 0.2 times the diameter D of the shank 13.

CLAIMS

1. A drill for hand tools having a shank wherein a closed longitudinal groove is formed, characterised in that the longitudinal groove is subdivided into longitudinal portions by at least one web, the ridge or surface of which conforms to the contour of the shank.

2. A drill as claimed in claim 1, characterised in that the distance between the end face of the shank and the end of the longitudinal groove adjacent said

end face is from 0.3 to 1.0 times the diameter of the shank.

3. A drill as claimed in claim 1 or 2, characterised in that the width of the web is from 0.4 to 1.1 times the diameter of the shank.

4. A drill as claimed in claim 1, 2 or 3, characterised in that the length of each longitudinal portion of the longitudinal groove is from 0.7 to 1.7 times the diameter of the shank.

5. A drill as claimed in any preceding claim characterised in that the depth of the longitudinal groove is from 0.1 to 0.3 times the diameter of the shank.

6. A drill as claimed in any preceding claim characterised in that the longitudinal portions of the groove are V-shaped in cross-section.

7. A drill as claimed in claim 6, characterised in that the angle formed between the flanks of the longitudinal portions is in the range from 50° to 130°.

8. A drill as claimed in claim 7, characterised in that the angle formed between the flanks of the longitudinal portions is in the range from 50° to 70°.

9. A drill for hand tools substantially as hereinbefore described with reference to the embodiment illustrated in Figure 1 or Figure 2 of the accompanying drawing.

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